Greetings and welcome to the **MAY 2014** edition of the WDFW Climate News Digest. Our purpose is to provide highlights of relevant climate change news, events and resources for WDFW staff. Feedback or suggestions for items to include in future editions are much appreciated – many *thanks* to those who have sent links and references and please keep them coming. Note that previous editions of the newsletter are now stored on the Habitat Program Sharepoint site -- http://sharepoint.dis.wa.gov/dfw/habitat/climatechange/default.aspx and on the agency's climate change web page.

Thanks for contributions this month from Maria Hunter, Marc Hayes, Eric Gardner and David Price.

WHAT'S HAPPENING AT WDFW?

Grant Program funds study on Sea Level Rise

With funding from the Marine and Nearshore Grant Program, Friends of the San Juans have developed a model that looks at both inundation and erosion to evaluate threats from sea level rise and climate change. Preliminary reports indicate that approximately 20 miles of public and private roads in San Juan County are vulnerable to inundation from sea level rise, with an additional 10 miles being vulnerable to erosion. The draft reports also find that there is substantial risk to shoreline structures, residences, and critical infrastructure, and that priority habitats, specifically ecologically critical forage fish spawning habitat, are particularly vulnerable to sea level rise as a result of increased shoreline armoring. This last point is emphasized in the study, as the reduction or disappearance of this critical habitat has implications for much of Puget Sound's food chain – including endangered and threatened salmon species.

Final reports and products from this study will be made available in the coming weeks. If you are interested in learning more, or would like copies of these reports, please contact Maria Hunter at the Marine and Nearshore Grant Program (Maria.Hunter@dfw.wa.gov) or visit the Marine and Nearshore Grant Program webpage (http://wdfw.wa.gov/grants/ps_marine_nearshore/)."

CLIMATE ADAPTATION AT OTHER ORGANIZATIONS

First Federal Ocean Acidification Strategic Plan Released

The Interagency Working Group on Ocean Acidification has recently released the "Strategic Plan for Federal Research and Monitoring of Ocean Acidification." The Plan will guide research and monitoring investments that will improve our understanding of ocean acidification, its potential impacts on marine species and ecosystems, and adaptation and mitigation strategies. Highlights of the Plan's research goals include: improve existing observing systems that monitor chemical and biological effects of ocean acidification and document trends; undertake laboratory and field research to examine the physiological, behavioral, and evolutionary adaptive capacities of selected species and complexes of species; develop comprehensive models to predict changes in the ocean carbon cycle and effects on marine ecosystems and organisms; develop vulnerability assessments for various carbon dioxide emissions scenarios; and, assess the cultural, subsistence, and economic effects of ocean acidification. To learn more, visit: http://oceanacidification.noaa.gov/IWGOA.aspx.

Northwest Climate Science Center releases Annual Report

The Northwest Climate Science Center (NW CSC) is pleased to announce the release of the NW CSC Annual Report for Fiscal Year 2013 (October 1, 2012 – September 30, 2013). The Annual Report highlights major accomplishments in FY13 for the NW CSC in each of the five core service areas (Executive, Science, Data,

Communications, and Education and Training) described in the NW CSC Strategic Plan. It also recognizes the hard work of the NW CSC's dedicated staff, academic colleagues, and regional partners. The Annual Report is available at
http://www.doi.gov/csc/northwest/news/nw-csc-annual-report-for-fy13-released.cfm

LEARNING OPPORTUNITIES

NOAA Announces Webinar Series on Ocean Acidification
NOAA's Ocean Acidification Program offers monthly webinars on communicating about ocean acidification for educators and other stakeholders. The series is called "Sharing Ocean Acidification Resources for Communicators and Educators" (SOARCE). One of its primary goals is to promote an integrated and effective ocean acidification education community. To learn more, visit: http://oceanacidification.noaa.gov/AreasofFocus/EducationOutreach/SOARCEWebinarSeries.aspx.

Friday, May 9, 8:30 - 10:00 AM, PST, National Climate Assessment,
Speakers Kathy Jacobs, Univ. of Arizona; Emily Cloyd, National Climate Assessment, USGCRP; Jim Buizer, Univ. of Arizona; and Anne Waple, Second Nature, Inc. will discuss new insights and implications from the National Climate Assessment to be released on May 6, 2014. Click here for more information.

Wednesday, May 14th, 2014, 10:00-11:00 AM PST, "Climate-Smart Conservation". Presenters include Dr. Bruce A. Stein, Director, Climate Change Adaptation, National Wildlife Federation, along with a panel of representatives from key federal agencies involved in the guide's development
This webinar explores the basic concepts behind climate-smart conservation. Following an overview, there will be a panel discussion among representatives of key federal agencies discussing opportunities for applying the principles of climate-smart conservation in the work of their agencies.
To register, go to: http://bit.ly/1fzczgu ***Please look for an email from WebEx "messenger". Check your spam folder if you do not receive the confirmation email with your log-in instructions after registering.***

Thursday, May 15th, 2014, 11:00 AM, PST, " Ungulates and Climate Change: an Examination of the Potential Impacts", presented by Matthew Kauffman, USGS Wyoming Cooperative Fish and Wildlife Research Unit. National Climate Change Wildlife Science Center webinar
https://nccwsc.usgs.gov/webinar/248

Thursday, May 15th, 2014, 10:00-11:30 AM, PST, "North Pacific LCC Conservation Planning Atlas Introduction and E-Forum"
The North Pacific LCC is pleased to announce the upcoming launch of our Conservation Planning Atlas (CPA). This new website has been in development since 2013 and is now ready for release and review. We invite you to join this webinar to learn about the CPA and to provide us feedback on how to make it more useful to you. The CPA is a data discovery, visualization, and analytical platform for stakeholders throughout the NPLCC area. With the CPA you can search for spatial datasets, access data for NPLCC supported projects, and learn more about landscape scale conservation science, design, and climate change in the region. Tom Miewald, NPLCC Data Coordinator, will provide an overview of the CPA and its functions. We will also dedicate time for you to provide us with your immediate feedback on how we can improve this tool. Register here

Wednesday, May 28th, 9:00 am to 4:00 pm, "Urban Forest Symposium: Climate Change and the Urban Forest", hosted by PlantAmnesty and the University of Washington Botanic Gardens at Center for

Urban Horticulture, 3501 NE 41st St, Seattle, WA 98105
Register: http://depts.washington.edu/uwbg/news/urban-forest/
This year's urban forest symposium takes an in-depth look at climate change and considers the impact to the urban forest. Learn about the climatic changes our region can expect and strategies that can be used to plan and manage for a healthy and resilient urban forest. Presenters will discuss the expected changes to the climate, urban forest responses, and what urban foresters and advocates can do to prepare.

Sept 9-10, 2014, Seattle, WA, **Fifth Annual Pacific Northwest Climate Science Conference,**
http://pnwclimateconference.org/
The PNW Climate Science Conference annually brings together more than 250 researchers and practitioners from around the region to discuss scientific results, challenges, and solutions related to the impacts of climate on people, natural resources, and infrastructure in the Pacific Northwest. Emphasis is on talks that are comprehensible to a wide audience on topics of broad interest. Stay tuned for further details regarding abstract submission, registration, and program news. In the meantime, please contact Lara Whitely Binder (lwb123@uw.edu) with any questions about the conference.

RESOURCES

New Book: "Climate Change and United States Forests"
This book provides resource managers, researchers, and the interested public with a comprehensive science-based assessment of the effects of climate change and variability on U.S. forests.

The April edition of the OWSC newsletter is now available on-line (also attached).
Topics include: a weather and climate summary of the wet March, snowpack update and temperature and precipitation outlook. Please direct comments and questions to climate@atmos.washington.edu.

AFWA releases two new resource documents.
Two new climate resource documents are now available on the AFWA website (Links below).
http://www.fishwildlife.org/files/ResourceGuide_NGO-Climate-Adaptation-Resources.pdf
http://www.fishwildlife.org/files/ResourceGuide_Federal-Climate-Adaptation-Programs.pdf

Teachers' guide explores climate change & wetlands
A new high school curriculum from Waquoit Bay Research Reserve, part of the National Estuarine Research Reserves, uses recent findings as a launching pad to study the connections between climate change and the economic value of salt marshes. The research project "Bringing Wetlands to Market" examines the connections among coastal wetlands, carbon dioxide uptake and storage, and the global carbon trading economy.
Explore the guide »

Climate Commons -- Interactive Map Combines NOAA Data with Climate Impact Reports
Climate Commons is an interactive map-based platform that contains layers of news and information on climate change in the United States.The map combines recent data on climate change indicators and emissions with geo-tagged stories on climate change.
Access the Climate Commons Map »

CLIMATE SCIENCE NEWS

U.N. Climate Report Authors Answer 11 Basic Questions
IPCC scientists answer 11 frequently asked questions about the impacts of global warming.

Scientists unmask the climate uncertainty monster
Scientific uncertainty has been described as a 'monster' that prevents understanding and delays mitigative action in response to climate change. New research by Professor Stephan Lewandowsky of the University of Bristol, and international colleagues, shows that uncertainty should make us more rather than less concerned about climate change. In two companion papers, published in *Climatic Change*, the researchers investigated the mathematics of uncertainty in the climate system and showed that increased scientific uncertainty necessitates even greater action to mitigate climate change. They show that as uncertainty in the temperature increase expected with a doubling of CO_2 from pre-industrial levels rises, so do the economic damages of increased climate change. Greater uncertainty also increases the likelihood of exceeding 'safe' temperature limits and the probability of failing to reach mitigation targets.

SPECIES AND HABITATS

Thinking globally and siting locally – renewable energy and biodiversity in a rapidly warming world
This article in the journal Climatic Change argues for the need to accept some and perhaps substantial risk of impacts to wildlife from renewable energy development in order to limit the far greater risks to biodiversity loss owing to climate change. The authors propose a path forward for better reconciling expedited renewable energy development with wildlife conservation in a warming world.

A Simple Model that Identifies Potential Effects of Sea-Level Rise on Estuarine and Estuary-Ecotone Habitat Locations for Salmonids in Oregon, USA, Rebecca Flitcroft, Kelly Burnett, and Kelly Christiansen. 2013. (pdf attached)
Excerpt from the abstract: Studies of the potential effects of climate change on salmonids have focused on both marine and freshwater environments. Access to a variety of estuarine habitat has been shown to enhance juvenile life-history diversity, thereby contributing to the resilience of many salmonid species. This study is focused on the effect of sea-level rise on the availability, complexity, and distribution of estuarine, and low-freshwater habitat for Chinook salmon *(Oncorhynchus tshawytscha),* steelhead (anadromous O. *mykiss),* and coho salmon (O. *kisutch)* along the Oregon Coast under future climate change scenarios.

Deforestation of Sandy Soils a Greater Climate Threat
(from Science Daily)
Deforestation may have far greater consequences for climate change in some soils than in others, according to new research led by Yale University scientists -- a finding that could provide critical insights into which ecosystems must be managed with extra care because they are vulnerable to biodiversity loss and which ecosystems are more resilient to widespread tree removal. In a comprehensive analysis of soil collected from 11 distinct U.S. regions, from Hawaii to northern Alaska, researchers found that the extent to which deforestation disturbs underground microbial communities that regulate the loss of carbon into the atmosphere depends almost exclusively on the texture of the soil. The results were published in the journal *Global Change Biology.* "We were astonished that biodiversity changes were so strongly affected by soil texture and that it was such an overriding factor," said Thomas Crowther, a postdoctoral fellow at the Yale School of Forestry & Environmental Studies and lead author of the study. "Texture overrode the effects of all the other variables that we thought might be important, including temperature, moisture, nutrient concentrations, and soil pH."

Wildlife response to climate change is likely underestimated, experts warn

(from Science Daily)

Analyzing thousands of breeding bird surveys sent in by citizen scientists across the western United States and Canada over 35 years, wildlife researchers report that most of the 40 songbird species they studied shifted either northward or toward higher elevation in response to climate change, but did not necessarily do both. This means that most previous studies of potential climate change impacts on wildlife that looked only at one factor or the other have likely underestimated the effects of environmental warming, say research wildlife biologists David King at the University of Massachusetts Amherst and Sonya Auer of the University of Glasgow, U.K. Their study appears in the current issue of *Global Ecology and Biogeography*. They found that "generally speaking, birds with smaller clutch sizes showed greater shifts in latitude, but greater clutch size showed more shift in elevation," King says. "A more satisfying marker is the diet breadth, where we found birds with narrower diet breadth shifted farther up in latitude and elevation than birds with wider diet breadths, which is what we expected to see."> *full story*

Climate change, pink salmon, and the nexus between bottom-up and top-down forcing in the subarctic Pacific Ocean and Bering Sea

Alan M. Springer and Gus B. van Vliet, PNAS March 4, 2014

Abstract: Climate change in the last century was associated with spectacular growth of many wild Pacific salmon stocks in the North Pacific Ocean and Bering Sea, apparently through bottom-up forcing linking meteorology to ocean physics, water temperature, and plankton production. One species in particular, pink salmon, became so numerous by the 1990s that they began to dominate other species of salmon for prey resources and to exert top-down control in the open ocean ecosystem. Information from long-term monitoring of seabirds in the Aleutian Islands and Bering Sea reveals that the sphere of influence of pink salmon is much larger than previously known. Seabirds, pink salmon, other species of salmon, and by extension other higher-order predators, are tightly linked ecologically and must be included in international management and conservation policies for sustaining all species that compete for common, finite resource pools. These data further emphasize that the unique 2-y cycle in abundance of pink salmon drives interannual shifts between two alternate states of a complex marine ecosystem.

Endangered butterfly defies climate change with new diet and habitat

A butterfly species whose population collapsed because of climate change and habitat loss has defied predictions of extinction to rapidly move to cooler climes and change its food plant. The quino checkerspot (*Euphydryas editha quino*), found in Mexico and California , has shifted to higher altitudes and surprisingly chosen a completely different species of plant on which to lay its eggs, according to research presented at the Butterfly Conservation's seventh international symposium in Southampton. Its rapid adaption offers hope that other insects and species may be able to adapt unexpectedly quickly to climate change. But the international symposium also heard strong scientific evidence that climate change will create more losers than winners because unspoilt habitat is sofragmented, preventing many butterflies, moths and other insects from moving to more suitable places.

Shifting bird and reptile distributions

With climate change come several dramatic shifts in species distribution within the United States. The U.S. Geological Survey in concert with the University of New Mexico and Northern Arizona University have recently projected distribution losses for nearly half of the 5 examined reptile species including the locally famed chuckwalla. Breeding bird ranges, however exhibited broader expansions and contractions within their breeding habitats. (See attached)

POLICY AND MANAGEMENT - MITIGATION AND ADAPTATION

Gov. Inslee announces executive action to reduce carbon pollution and promote clean energy
Gov. Jay Inslee signed an executive order on April 29th outlining a series of steps to cut carbon pollution in Washington and advance development and use of clean energy technologies. "This is the right time to act, the right place to act and we are the right people to act," Inslee said in remarks delivered at Shoreline Community College's Professional Automotive Training Center. Inslee's executive order builds on earlier studies and work groups to create an action plan in six key areas. It does not implement any new programs, instead setting out a deliberative and public process. Most of the major action plan elements below will require either legislative approval or legislative appropriation for funding.

Private forests are key to mitigating climate change, group says
(from DailyClimate.org)
A group of forest organizations and businesses is pushing the administration to support working forests on private lands in efforts to sequester carbon.
The Forest Climate Working Group, a coalition of 19, this morning released its recommendations to the Obama administration on how to leverage forests as a tool for climate change mitigation. There are 751 million acres of forestland in the United States, and more than half of that is privately owned, according to the American Forest Foundation. Fifty-nine percent of the carbon stored on forest lands is in private forests. "The primary focus of our recommendations is to look at private forestlands as a lever" for climate change mitigation and adaptation, said Jad Daley, director of the Trust for Public Land's Climate Conservation Program and co-chairman of the Forest Climate Working Group. With the many programs to help private landowners, it makes sense to push the Agriculture Department -- which houses the Forest Service and the Natural Resources Conservation Service -- to create incentives within an existing infrastructure, he said.

IPCC Climate Change 2014 -- Summaries for Policymakers Provide Guidance for Action
(the following section provided by the Climate Impacts Research Consortium)
The Intergovernmental Panel on Climate Change (IPCC) recently released the summaries for policymakers for the reports by Working Groups 2 and 3. They are highlighted below.

Impacts, Adaptation, and Vulnerability
Working Group 2 has created a practical "guide to action," evaluating current and future patterns of risks and potential benefits from climate variability and change. Using social science to suggest how policies can be adjusted and communities can adapt, the report analyzes impacts, risks, values and co-benefits. Specifically, it "assesses needs, options, opportunities, constraints, resilience, limits, and other aspects associated with adaptation." Five "reasons for concern" provide a framework for assessing risks across contexts, through time, either cumulatively or from single events, and at what scales (local to global), to judge when impacts may become dangerous across regions and sectors.

As summarized in the journal *Science* by Eli Kintisch, the report discusses categories of climate risks that will begin to appear when global average temperature rises by 1 to 2 degrees Celsius and that will become worse at higher temperatures. They are:

1. Death or harm from coastal flooding
2. Harm or economic losses from inland flooding
3. Extreme weather disrupting electrical, emergency, or other systems
4. Extreme heat, especially for the urban and rural poor
5. Food insecurity linked to warming, drought or flooding
6. Water shortages causing agricultural or economic losses
7. Loss of marine ecosystems essential to fishing and other communities
8. Loss of terrestrial and inland water ecosystems

The summary includes a number of points relevant to the Pacific Northwest (shown here along with the scientists' levels of assessed confidence):

- Changing precipitation and melting are altering hydrological systems and runoff patterns and are impacting water quantity and quality (medium confidence)
- Glaciers will continue to shrink worldwide; terrestrial and aquatic species "have shifted their geographic ranges, seasonal activities, migration patterns, abundances, and species interactions"; ocean acidification poses substantial risks to shellfish; and negative impacts on crops such as wheat are more common than positive (high confidence)
- Many human systems and some ecosystems are vulnerable to extreme events, such as floods, drought and wildfires under current climate variability (very high confidence)

Mitigation of Climate Change

Working Group 3 reports on the scientific, technological, environmental, economic and social aspects of mitigation of climate change. The report also assesses mitigation options based on governance, economic activity, and societal implications of policy interventions but does not recommend any particular option for mitigation. Climate policy may be informed by a diverse array of risks and uncertainties, some of which are difficult to measure, notably low-probability, high-consequence events. Globally, economic and population growth continue to be the most important drivers of increases in CO_2 emissions. The contribution of population growth between 2000 and 2010 remained roughly identical to the previous three decades, while the contribution of economic growth has risen sharply. About half of cumulative CO_2 emissions between 1750 and 2010 have occurred in the last 40 years. Annual emissions have increased by 10 gigatons between 2000 and 2010, with this increase directly coming from energy supply (47 percent), industry (30 percent), transport (11 percent), and buildings (3 percent).

Effective costs of mitigation vary widely, but without additional efforts to reduce greenhouse gas emissions beyond those in place today, emissions growth is expected to persist. A target of 450 parts per million or less in atmospheric CO2 concentrations likely is needed to keep temperature increases below 2 degrees Celsius, necessitating 40 to 70 percent cuts in emissions by mid-century through large-scale changes in energy systems, buildings and infrastructure, transportation, urbanization, forestry, agricultural and land-use practices (high confidence, medium to high robustness, medium to high agreement).

References:

Science 4 April 2014: Vol. 344 no. 6179 p. 21 DOI: 10.1126/science.344.6179.21 Climate Science: In New Report, IPCC Gets More Specific About Warming Risks by Eli Kintisch http://www.sciencemag.org/content/344/6179/21.full

Intergovernmental Panel on Climate Change (IPCC) Climate Change 2014: Impacts, Adaptation, and Vulnerability - SUMMARY FOR POLICYMAKERS WGII AR5 Phase I Report Launch 31 March 2014 http://ipcc-wg2.gov/AR5/

Intergovernmental Panel on Climate Change (IPCC) - Climate Change 2014: Mitigation of Climate Change (Working Group 3) - SUMMARY FOR POLICYMAKERS http://mitigation2014.org/report/summary-for-policy-makers